Londa Schiebinger
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Director, Gendered Innovations in Science, Health & Medicine, Engineering, and Environment
“Gendered Innovations” employs methods of sex and gender analysis to create new knowledge.
Percentage of EC Horizon 2020 grants funded in 2015 that integrated sex or gender analysis into research:

- 36%

Can we harness the creative power of sex & gender analysis for discovery?
THREE FIXES

1. FIX THE NUMBERS OF WOMEN
2. FIX THE INSTITUTIONS
3. FIX THE KNOWLEDGE
3 FIX THE KNOWLEDGE
Between 1997 and 2000, 10 drugs were withdrawn from the U.S. market because of life-threatening health effects—8 of those showed greater severity in women (GAO, 2001).
Doing Research Right Saves Lives and Money

WHI Hormone Therapy Trials

- Each $1 spent returned $140 to US taxpayers in health care savings

- Health Improvements
  * 76,000 fewer cases of cardiovascular disease
  * 126,000 fewer breast cancer cases
  * 145,000 more quality-adjusted life years

  * However: 263,000 more osteoporotic fractures

Gendered Innovations

1) develop state-of-the-art Methods of sex and gender analysis

2) provide Case Studies to illustrate how gender analysis leads to discovery and innovation.
Most research is done in males

Percentage of articles reporting sex of cells used in the experiments

<table>
<thead>
<tr>
<th>Cell Line</th>
<th>Sex</th>
<th>Description</th>
<th>Species</th>
<th>Year</th>
<th>Origin</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>5637</td>
<td>Male</td>
<td>Urinary bladder epithelium</td>
<td>Human</td>
<td>1974</td>
<td>C</td>
<td>(68, 69)</td>
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<tr>
<td>3T3-L1</td>
<td>Male</td>
<td>Embryo fibroblast</td>
<td>Mouse</td>
<td>1962</td>
<td>N</td>
<td>(84, 85)</td>
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<tr>
<td>16HBE</td>
<td></td>
<td>Lung epithelial</td>
<td>Human</td>
<td></td>
<td>N</td>
<td>(46, 88)</td>
</tr>
<tr>
<td>A549</td>
<td>Male</td>
<td>Lung epithelial</td>
<td>Human</td>
<td>1972</td>
<td>C</td>
<td>(79, 137)</td>
</tr>
<tr>
<td>A6</td>
<td>Male</td>
<td>Kidney epithelial</td>
<td>Xenopus</td>
<td>1965</td>
<td>N</td>
<td>(165,222)</td>
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<tr>
<td>A7r5</td>
<td></td>
<td>Aorta smooth muscle</td>
<td>Rat</td>
<td>1976</td>
<td>N</td>
<td>(15, 183)</td>
</tr>
<tr>
<td>AGS</td>
<td>Female</td>
<td>Stomach epithelial</td>
<td>Human</td>
<td>1979</td>
<td>C</td>
<td>(10, 11)</td>
</tr>
<tr>
<td>AML-12</td>
<td>Male</td>
<td>Liver epithelial</td>
<td>Mouse</td>
<td>1994</td>
<td>N</td>
<td>(61, 282)</td>
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<tr>
<td>AML-193</td>
<td>Female</td>
<td>Lymphoblast</td>
<td>Human</td>
<td>1987</td>
<td>C</td>
<td>(131,229)</td>
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<tr>
<td>ARPE-19</td>
<td>Male</td>
<td>Retinal pigmented epithelial</td>
<td>Human</td>
<td>1986</td>
<td>N</td>
<td>(62, 101)</td>
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<tr>
<td>BeWo</td>
<td>Female</td>
<td>Placenta</td>
<td>Human</td>
<td>1966</td>
<td>N</td>
<td>(193,194)</td>
</tr>
<tr>
<td>BHK</td>
<td></td>
<td>Kidney fibroblast</td>
<td>Syrian hamster</td>
<td>1961</td>
<td>N</td>
<td>(146,148) . . .</td>
</tr>
</tbody>
</table>
# 15-Year Outcomes for Heart Transplant

<table>
<thead>
<tr>
<th>Years post-HT</th>
<th>MD-MR (n=40,497) Mean Survival %</th>
<th>FD-MR (n=13,480) Mean Survival %</th>
<th>MD-FR (n=6,436) Mean Survival %</th>
<th>FD-FR (n=7,420) Mean Survival %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>83.74</td>
<td>78.95</td>
<td>82.94</td>
<td>81.92</td>
</tr>
<tr>
<td>5</td>
<td>67.18</td>
<td>62.49</td>
<td>68.94</td>
<td>68.83</td>
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<tr>
<td>10</td>
<td>51.97</td>
<td>47.53</td>
<td>51.79</td>
<td>52.08</td>
</tr>
<tr>
<td>15</td>
<td>33.19 <strong>bold</strong></td>
<td>29.63</td>
<td>35.37</td>
<td>37.05 <strong>bold</strong></td>
</tr>
</tbody>
</table>

**Best outcomes: female-to-female and male-to-male**

Definition of Terms

SEX = biological characteristics

GENDER = cultural attitudes and behaviors
Sex and Gender Interact
DANGER!

- That PIs confound sex with gender

- That PIs “see” sex (or a biological trait), when they are really looking at “gender” (or an environmental condition that may impact male and female animals differently).

Integrating Sex & Gender into Animal Research

Social Dynamics
Sex-segregated or male/female mix?
Number and mix of animals in lab?

Caging
Individual or group? Size?
Complex environment vs. no enrichment?
Microbially sterile?

Diet

Researcher/Staff
Sex of researcher/staff?
Research/staff handling of male/female animals?

Room
Temperature?
Sound?
Lighting (circadian)?
Odor?

genes
hormones
estrus cycle
age/reproductive phase
strain

Cost?

Gender in Heart Disease

- Can we reduce gender to variables so that results can be manipulated statistically?
Gender Variables in Health Research

Inspiration from Canada

Sex and Gender Interact

Seven Relevant Gender Factors

- household primary earner
- personal income
- number of hours per week spent doing housework
- status of primary person responsible for doing housework
- level of stress at home
- Bem Sex Role Inventory masculinity score
- Bem Sex Role Inventory femininity score
Acute Coronary Syndrome (aged 55 and younger)

- No sex difference
- Gender matters. Patients received a “gender-related score” of between 1 and 100. Patients with a higher “femininity” score—regardless whether they were men or women—were more likely to experience a recurrence of ACS.
No longer valid

- household primary earner
- personal income
- number of hours per week spent doing housework
- status of primary person responsible for doing housework
- level of stress at home
- Bem Sex Role Inventory masculinity score
- Bem Sex Role Inventory femininity score
Stanford Study

- Gender Variables in Health Research
Hoping for results in July

- Londa Schiebinger, Mathias Wullum Nielsen, Claudette Brooks, Mark R. Cullen, Gillian Einstein, John P.A. Ioannidis, Ineke Klinge, Hannah LeBlanc, Torsten B. Neilands, Hee Young Paik, Diana Peragine, Louise Pilote, Judith Prochaska, Stephen Ristvedt, Kierstyn Smith, YoonJu Song, Marcia L. Stefanick
Seed Grants:

- One example: http://wsdm.stanford.edu/
Research Resources:

- Gendered Innovations website. genderedinnovations.stanford.edu


- August 2015: The Canadian Institutes for Health Research rolled out the first of three trainings for Sex and Gender in Biomedical Research. http://www.discoversexandgender.ca/
Research & Teaching Resources:


- Regitz-Zagrosek, V., (Ed.) (2012). *Sex and Gender Differences in Pharmacology*.

Sex and Gender-Based Medical Education Summit - A Roadmap for Curricular Innovation, Mayo Clinic, US, October 2015 https://ce.mayo.edu/special-topics-in-health-care/node/3095

Join the Gendered Innovations listserv

- On the Gendered Innovations website, sign up at “Contact Us.”
1. To move beyond binary notions of “masculinity” and “femininity.”

2. To capture three dimensions of gender:
   Norms
   Identity
   Relations
APPENDIX C. Gender-related score distribution in men and women with premature acute coronary syndrome.
Proposed Gender–Related Variables

Norms
- Responsibility for Caregiving
- Time use
- Occupation

Identity
- Competitive
- Independent
- Risk–taking
- Communal
- Expressive

Relations
- Social support
- Perceived discrimination
- Quality of family relationships
How often do you worry about what other people think about you?

When making an important decision in your personal life, how often do you take other peoples’ needs into account?

How often do friends talk to you about their problems?

How easy is it for you to spot when someone in a group is feeling uncomfortable?
Physician Gender Attitudes Interact with Patient Sex and Gender